Dynamic analysis of concrete structural behaviour - Estimation of seismic vulnerability of Andorran Civil Protection building

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ABSTRACT

This work is a part of the cross-border area POCRISC project. POCRISC EFA158/16 project is 65% financed by the European Regional Development Fund (ERDF) through the Interreg V-A Spain France Andorra program (POCTEFA 2014-2020). POCTEFA aims to reinforce the economic and social integration of the French–Spanish–Andorran border. Its support is focused on developing economic, social and environmental cross-border activities through joint strategies favoring sustainable territorial development. The project started in January 2018 and lasts 3 years (2018-2020). The objective of this international collaboration is to provide tools for assessing seismic vulnerability and risk in the Pyrenees, and thereby promote the dissemination of the common and shared information to both local authorities and the public.

To address such issue, we intend to answer to the two first Structural Health Monitoring (SHM) levels namely: damage detection and damage localization using Modal Operational Analysis (MOA) coupled with numerical modelling by Finite Element (FE). To illustrate such methodology, a concrete building located in Andorre la Vieille (Andorra) is numerically modelled. The structural behaviour of the building is studied through frequency computation method in order to identify its undamaged behaviour. A seismic event is next simulated by a non-linear dynamic computation method to create damage within the structure. Numerical results (eigen frequency, modal shapes and damage location) allow to highlight damaged zones induced by the earthquake and quantify degradation level in these areas. Some discussion is also provided according to the results sensitivity to materials properties and damage evolution law.

Keywords: seismic damage; operational modal analysis; numerical modelling; frequency computation method